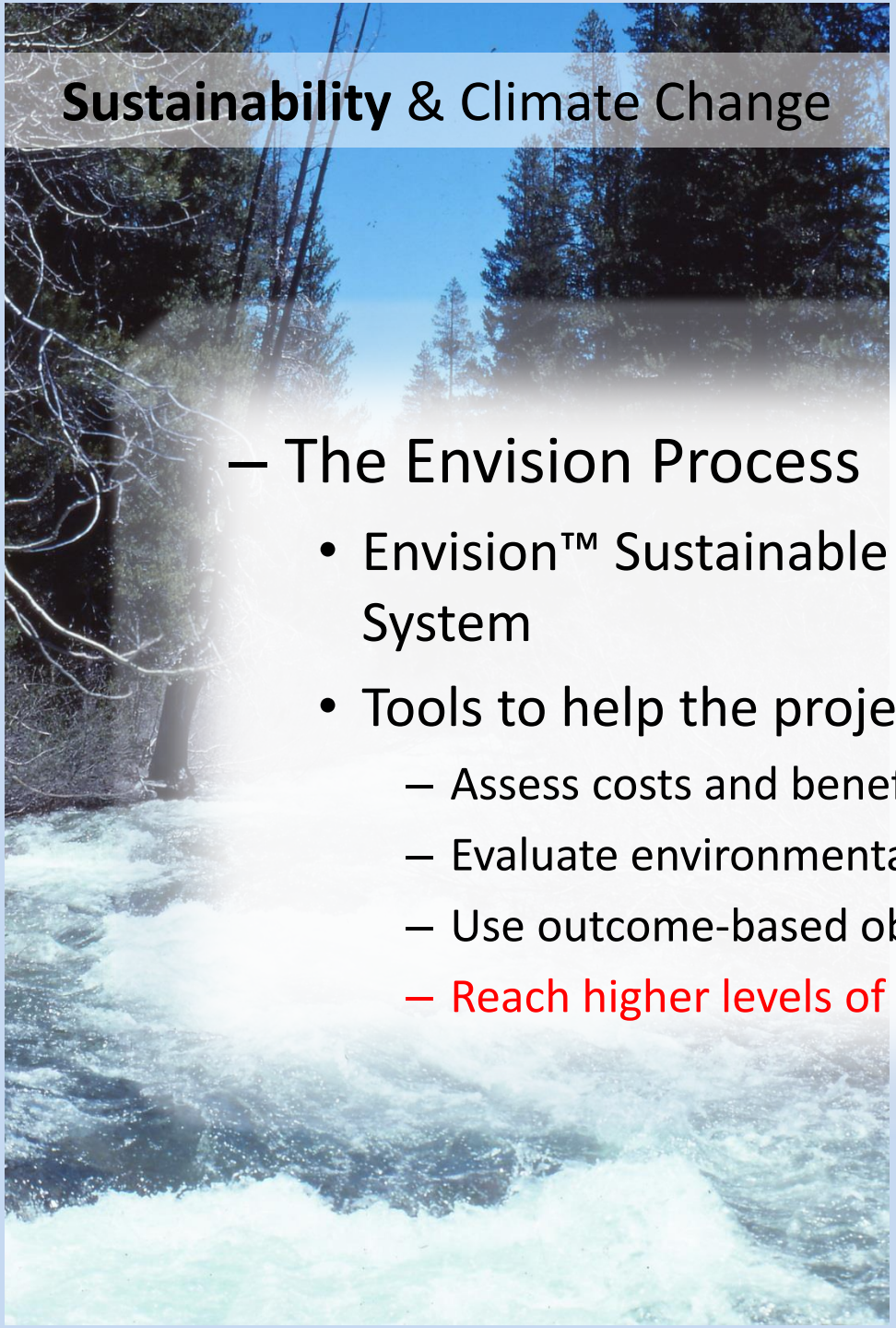
Sustainability & Climate Change

Capacity Building Workshop, Module 2B

Sustainability & Climate Change

- Sustainability Concepts and Tools
- Climate Change/Vulnerability Assessment Tools



Sustainability & Climate Change

- The Envision Process
  - Envision™ Sustainable Infrastructure Rating System
  - Tools to help the project design team:
    - Assess costs and benefits over the project lifecycle.
    - Evaluate environmental benefits.
    - Use outcome-based objectives.
    - Reach higher levels of sustainability achievement

Sustainability & Climate Change

- National Climate Change Adaptation Forum 2013
- California Adaptation Forum
  - Network of adaptation leaders
  - 1st Meeting last August 2014
    - Intensive program content available on-line
    - Example methods of assessing roadblocks to climate change adaptation, lessons learned, and success stories from planners, consultants, and policy makers
    - http://www.californiaadaptationforum.org/program/presentations

Sustainability & Climate Change

Other Sustainability Topics

- Sustain IRWM Planning & Implementation:
  - Preserve or increase momentum
  - Reduce competition among stakeholders
  - Ensure effective governance structure
  - Improve Implementation Plan execution and identify funding
- Address Socio-Economic Concerns:
  - Reduce competition for limited resources
  - Increase opportunities through partnerships
  - Build self-reliance
  - Fix deteriorating infrastructure
  - sensitively increase revenues for needed benefits
- Assess the adequacy of energy supply

Climate Change and Vulnerability Assessments

- IRWM planning standard related to projects
- Requires region-specific analysis of level of risk of predicted climate change effects and related impacts
  - For example, increased temperature causes increased irrigation
- Many California Water Plan Resource Management Strategies are also climate change adaption strategies

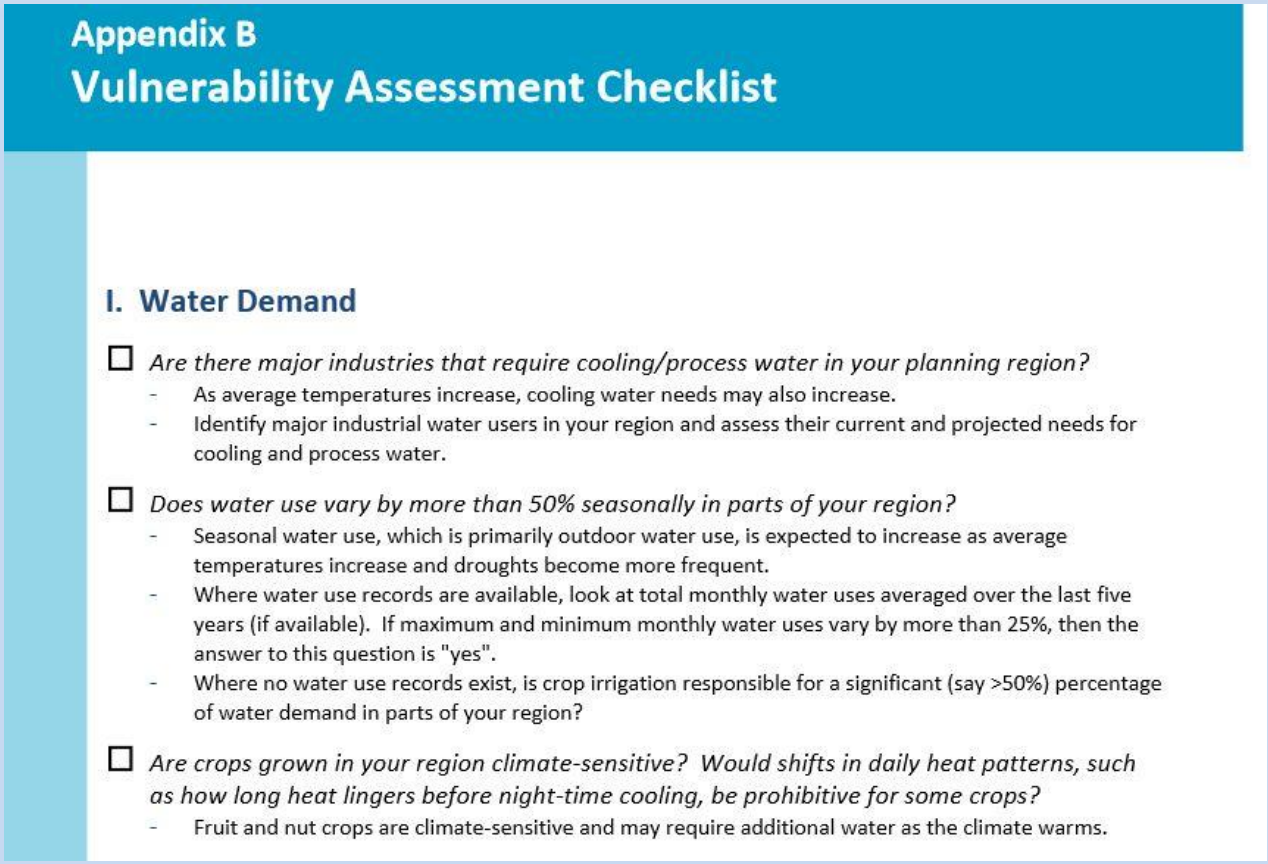
Sustainability & **Climate Change**

DWR Climate Change Resources Webpage

- http://www.water.ca.gov/climatechange/resources.cfm
- Technical Resources
  - Climate Change Handbook for Regional Water Planning
  - GHG Assessment for CEQA Purposes
  - Coastal and Oceans Climate Action Team (CO-CAT) Sea Level Rise
  - California's Climate Adaptation Water Strategy
- General Information Resources
  - Document Clearinghouse
  - Vulnerability Matrix
  - DWR Activities Summary
  - ****NEW** Tribal Vulnerability and Adaptation Matrices**

Sustainability & **Climate Change**

- Climate Change Handbook for Regional Planning
  - Appendix B – Vulnerability Assessment Checklist
  - http://www.water.ca.gov/climatechange/docs/Appendix%20B%20Vulnerability%20Assessment%20Checklist-Final.pdf



Appendix B

Vulnerability Assessment Checklist

I. Water Demand

☐ *Are there major industries that require cooling/process water in your planning region?*
- As average temperatures increase, cooling water needs may also increase.
- Identify major industrial water users in your region and assess their current and projected needs for cooling and process water.

☐ *Does water use vary by more than 50% seasonally in parts of your region?*
- Seasonal water use, which is primarily outdoor water use, is expected to increase as average temperatures increase and droughts become more frequent.
- Where water use records are available, look at total monthly water uses averaged over the last five years (if available). If maximum and minimum monthly water uses vary by more than 25%, then the answer to this question is "yes".
- Where no water use records exist, is crop irrigation responsible for a significant (say >50%) percentage of water demand in parts of your region?

☐ *Are crops grown in your region climate-sensitive? Would shifts in daily heat patterns, such as how long heat lingers before night-time cooling, be prohibitive for some crops?*
- Fruit and nut crops are climate-sensitive and may require additional water as the climate warms.

Sustainability & **Climate Change**

Climate Change Vulnerabilities Matrix

	Drivers								
	Higher Temperatures	**Earlier snowmelt**	**More rain, less snow**	**More extreme flood events**	**Longer, more frequent droughts**	**Decrease in Freeze events**	**Sea Level Rise**	**More Erosion**	**More frequent & intense wildfires**
Water Management	Change in runoff timing; reduced cold water pool for meeting instream temp requirements; higher demands	Less water supply due to storage loss; water mgmt more difficult at multipurpose reservoirs	Less water supply; poor water quality; more stress on levees; less groundwater recharge	Levee stress/ failure; impacts to resevoir operations (flood control and storage); damage to conveyance	Less water supply; higher demands; reduced recreational opportunities; poor water quality; less groundwater recharge	Higher ag demands from longer growing season	Levee stress/ failure; higher demand to meet WQ[1] standards; saltwater intrusion; damage to conveyance	Levee stress/ failure; poor water quality; damage to conveyance	Higher demands for fire fighting; poor WQ from flash floods; accelerated runoff
Agriculture	More ET[2]; increased moisture deficits; longer growing season; higher demands; shifts in crop type; increase in pests/ disease[3]	Less summer water supply; reduced water supply reliability	More floodplain inundation; levee stress; reduced water supply reliability; shifts in crop types	Levee stress/ failure; reduced productivity; crop loss from flood events	Less supply; higher demands; reduced productivity; invasive species; increase in pests/ disease; shifts in crop types	Longer growing season; higher demands; invasive species; increase in pests/ disease; shifts in crop types; decreased yield (crop specific)	Levee stress/ failure; saltwater intrusion; inundation; poor WQ; loss of ag land	Levee stress/ failure; poor water quality; loss of ag land	Poor WQ; loss of range lands; crop loss
Forests	More ET; increased moisture deficits; longer growing season; biodiversity shifts; increase in pests/ disease	Increased moisture deficits; biodiversity shifts	Reduced biomass; biodiversity shifts	Increased erosion; changes to riparian vegetation	Reduced biomass; increase in pests/ disease; biodiversity shifts; invasive species; increase in fire frequency/intensity	Longer growing season; invasive species; increase in pests/ disease	Coastal access-road damage from storm surges: economical and recreational losses	Reduced water quality; reduced productivity for aquatic species	Reduced biomass; more disease; biodiversity shifts; altered fire regime; economic and recreational losses; increased erosion
Ecosystems	Increased water temp and moisture deficits;biodiversity shifts; increase in disease/ invasives; phenological[4] changes	Barriers to species migration/ movement; phenological changes	Biodiversity shifts; increased water temp; reduced stream flow; invasive species	Poor WQ; reduced productivity; biodiversity shifts; economic and recreational losses; stream channel changes	Stream flows altered; biodiversity shifts; invasive species; increase in diseases; loss of ecosystem goods and services	Longer growing season; biodiversity shift; increase in disease/ invasive species; phenological changes	Loss of ecosystem goods and services; biodiversity shifts; loss of tidal wetland habitat; saltwater intrusion	Poor WQ; reduced productivity; displacement; stream channel changes	Fire regimes altered; habitat loss; poor WQ; biodiversity shifts; economic and recreational losses
Public Health & Safety	Mortality rates increase; poor air quality; allergens increase; less water supply; Illnesses[5] exacerbated	Less water supply	Change in prevalence & spread of disease; reduced water supply reliability; poor water quality	Change in prevalence & spread of diseases; mortality; displacement[6]	Change in prevalence & spread of diseases; mortality; reduced water supply reliability; increased malnutrition	Higher pesticide use; allergens increase; Illnesses exacerbated	Displacement; illness due to poor water quality;	Displacement; poor water quality; mudslides	Poor water quality; poor air quality; displacement; Illnesses, esp. respiratory, exacerbated; mortality; mudslides
Infrastructure	Higher summer energy demand; increased outages	Less summer/ fall hydropower production	Less summer/ fall hydropower production; more reservoir spills	Damage to transportation, wastewater, and energy infrastructure	Higher energy demand; reduced water supply; increased outages	Higher agricultural energy demand	Structural damage and inundation in coastal areas	Damage to transportation, wastewater, and energy infrastructure	Damage to transportation, wastewater, and energy infrastructure
Coastal Resources	Productivity reduced; biodiversity shifts; changes in commercial & recreational fisheries	N/A	Freshwater outflow reduced during summer/fall	Poor WQ; sediment transport altered	Poor WQ; less coastal fog; reduced freshwater outflow	N/A	Flooding & inundation; reduced ag; displacement; reduced tourism; loss of tidal wetlands	Poor WQ; displacement	Poor water quality; biodiversity shifts; habitat loss; economical and recreational losses

Sustainability & **Climate Change**

DWR Climate Change Activities

Decision Scaling Approach

Projection driven vs Decision Scaling

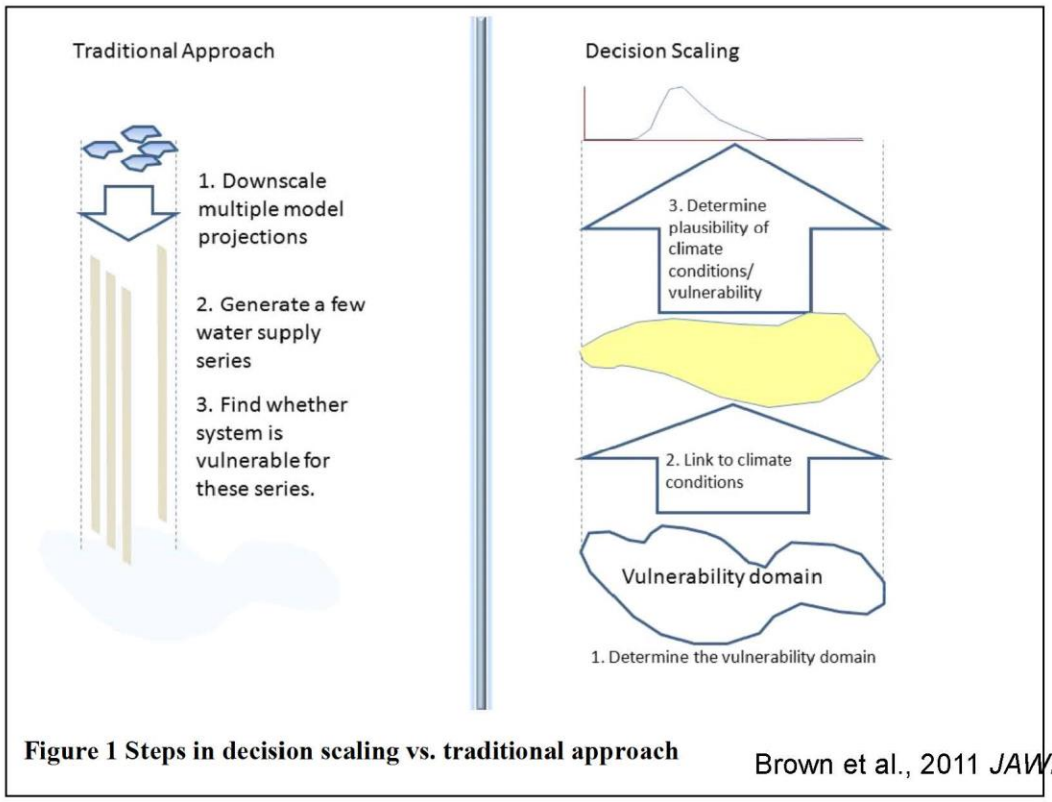


Figure 1 Steps in decision scaling vs. traditional approach

Brown et al., 2011 *JAWRA*

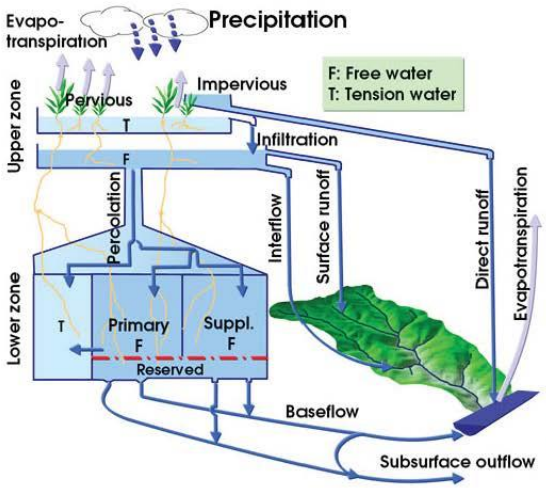
DWR Climate Change Vulnerability Assessment Approach

CalLite Inflow from SAC-SMA

Original VIC < VIC with improved routing < SAC-SMA

23% of inflow to CalLite – Big Improvement Here

SAC-SMA + SNOW17



Schematic of SAC-SMA

VIC Basin	NSE From VIC (CA DWR)	NSE From VIC (UMASS)	NSE From SAC-SMA
FOL_I	0.82	0.84	**0.96**
LK_MC	0.89	0.90	**0.95**
N_MEL	0.81	0.84	**0.91**
MILLE	0.56	0.65	**0.92**
PRD_C	-1.20	0.37	**0.80**
N_HOG	-629	0.65	**0.96**
OROVI	0.88	0.88	**0.95**
DPR_I	0.76	0.82	**0.94**
SHAST	0.87	0.91	**0.97**
TRINI	-	0.82	**0.91**
SMART	-0.42	0.70	**0.91**

Sustainability & Climate Change

RCD Erosion Control and TUD Phoenix Lake Projects Concepts

- Lindsay Mattos, Tuolumne County Resource Conservation District
- (209) 984-0500
- lindsay@tcrcd.org

Tuolumne-Stanislaus IRWM

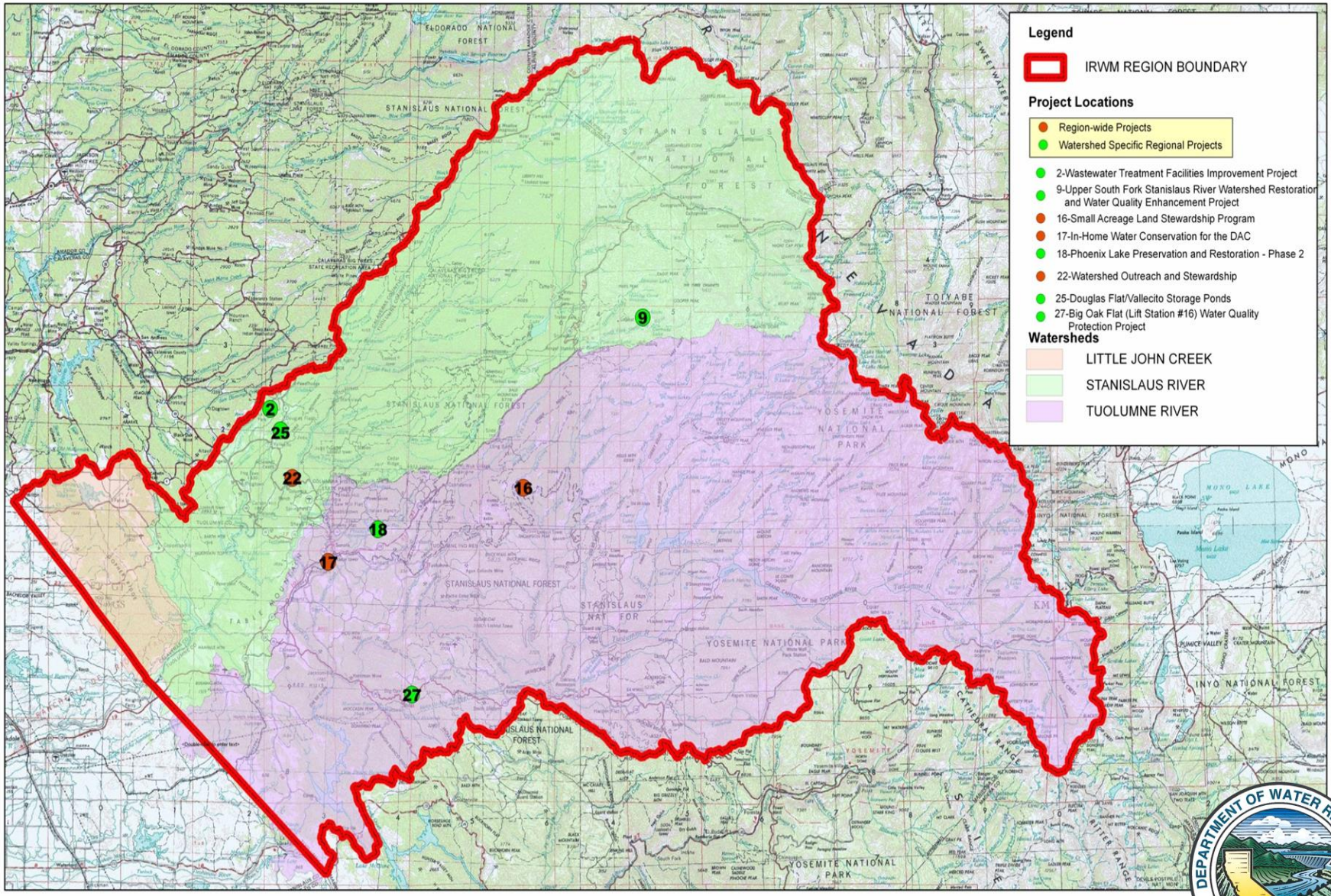
Lindsay Mattos, Administrator

tsirwm@gmail.com

Tuolumne Stanislaus IRWM Region

Figure 3-1

Watersheds and Project Locations



T-Stan Project Selection

- Criteria used in project selection:
  - *Project Description*
  - *Project Benefits*
  - *T-S IRWM Primary Objectives*
  - *Purpose and Need*
  - *Integrated Elements of Project*
  - *Existing Data and Studies*
  - **Readiness to Proceed*

- Scoring by a committee of members and stakeholders is used to rank projects for inclusion in the T-S IRWM Plan.

T-Stan Round 2 Proposal

Project No.	Implementing Agency/Entity	Project Amount	Project Title
2	Murphys Sanitary District	$ 285,000	Wastewater Treatment Facilities Improvement Project
9	USDA Forest Service, Stanislaus National Forest	$ 350,000	Upper South Fork Stanislaus River Watershed Restoration and Water Quality Enhancement Project
16	Tuolumne County Resource Conservation District	$ 255,000	Small Parcel Storm Water Pollution Prevention and Landowner Stewardship Program
17	Amador Tuolumne Community Action Agency	$ 200,000	Home-Level Water Conservation for the DAC
18	Tuolumne Utilities District	$ 1,700,000	Phoenix Lake Preservation and Restoration - Phase 2
22	Tuolumne River Trust	$ 50,000	Watershed Outreach and Stewardship
25	Calaveras County Water District	$ 200,000	Douglas Flat/Vallecito Storage Ponds
27	Groveland Community Services District	$ 600,000	GCSD/Big Oak Flat (Lift Station #16) W Quality Protection Project
	TOTAL	**$ 3,640,000**	

Project Integration

Projects in Round 2 Proposal either:

- Interface directly with one another ***or***
- are working toward complementary and mutual goals:
  - *water supply and infrastructure*
  - *water quality*
  - *water conservation and reuse*
  - *watershed rehabilitation and habitat improvement*
  - *flood management*

Collaboration and Sustainability

- *Upper South Fork Stanislaus River Watershed Restoration and Water Quality Enhancement Project* will work to restore degraded wet meadows and stream zones, and reduce overall sedimentation and contaminated runoff into the Stanislaus River.
- *Small Parcel Storm Water Pollution Prevention & Landowner Stewardship Program* will raise awareness and teach sustainable small property management practices that will reduce water quality impacts including erosion, sedimentation, pollution, and riparian habitat degradation.
- *Phoenix Lake Preservation and Restoration- Phase 2* project seeks to reverse the dwindling storage capacity and declining water quality in a reservoir which serves half of all TUD customers.

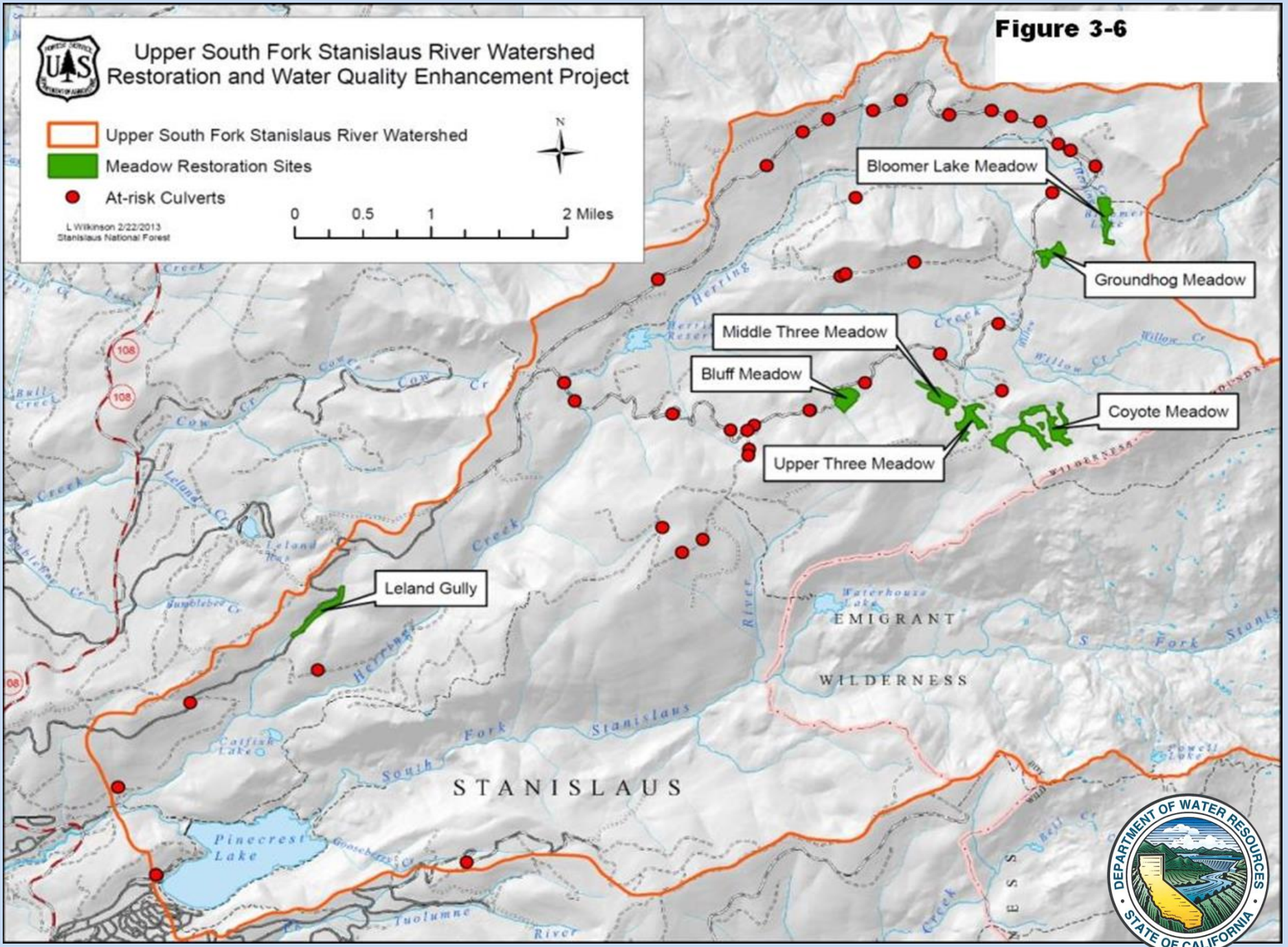
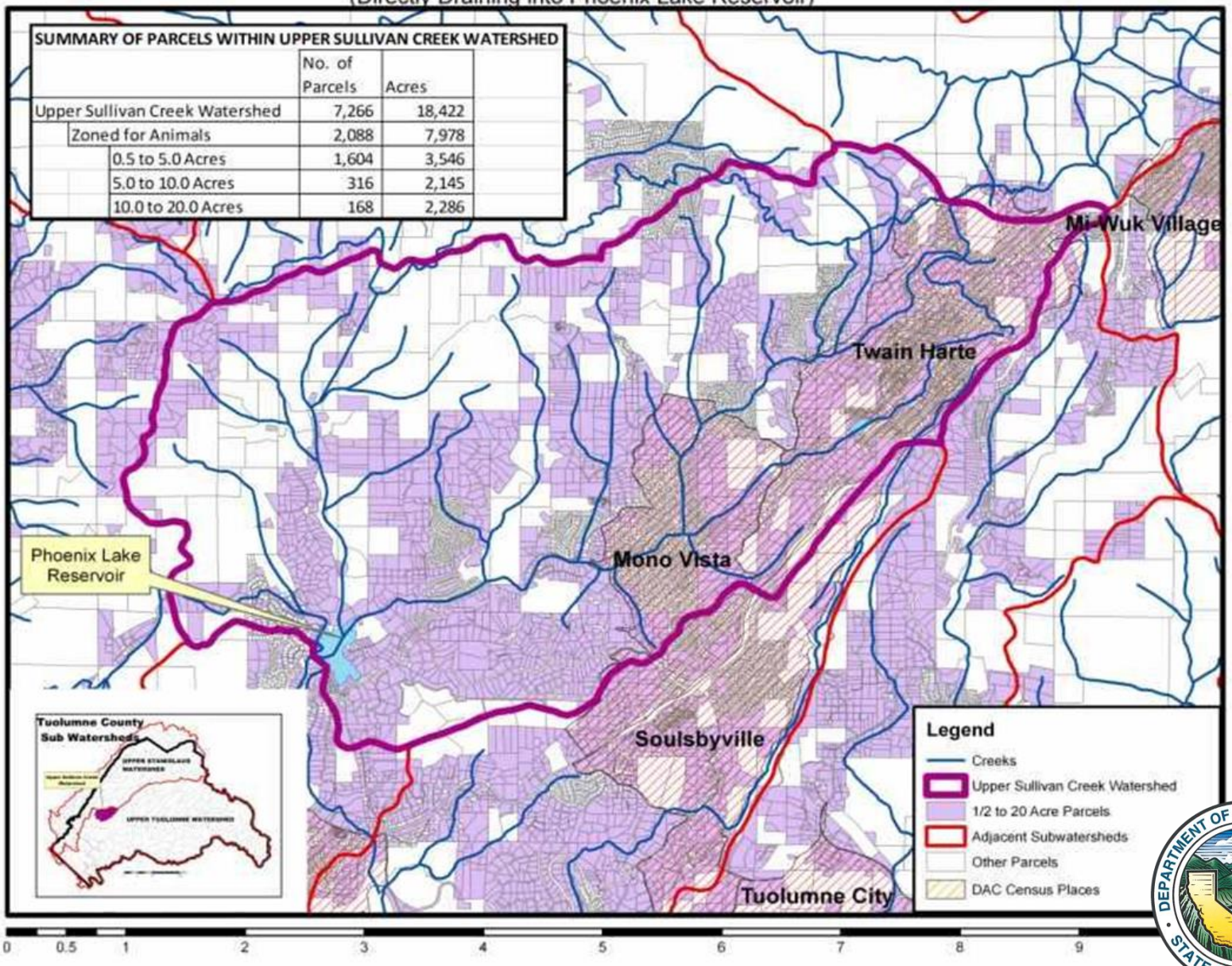


Figure 3-6
Upper South Fork Stanislaus River Watershed Restoration and Water Quality Enhancement Project
Upper South Fork Stanislaus River Watershed
Meadow Restoration Sites
At-risk Culverts
L Wilkinson 2/22/2013
Stanislaus National Forest
N
0
0.5
1
2 Miles
Bloomer Lake Meadow
Groundhog Meadow
Middle Three Meadow
Bluff Meadow
Coyote Meadow
Upper Three Meadow
Leland Gully
EMIGRANT
WILDERNESS
STANISLAUS
Pinecrest Lake
Herring Creek
Cow Creek
Leland Creek
Willow Cr
Waterhouse Lake
South Fork Stanislaus River
Tuolumne River
108
DEPARTMENT OF WATER RESOURCES
STATE OF CALIFORNIA

Figure 3-8

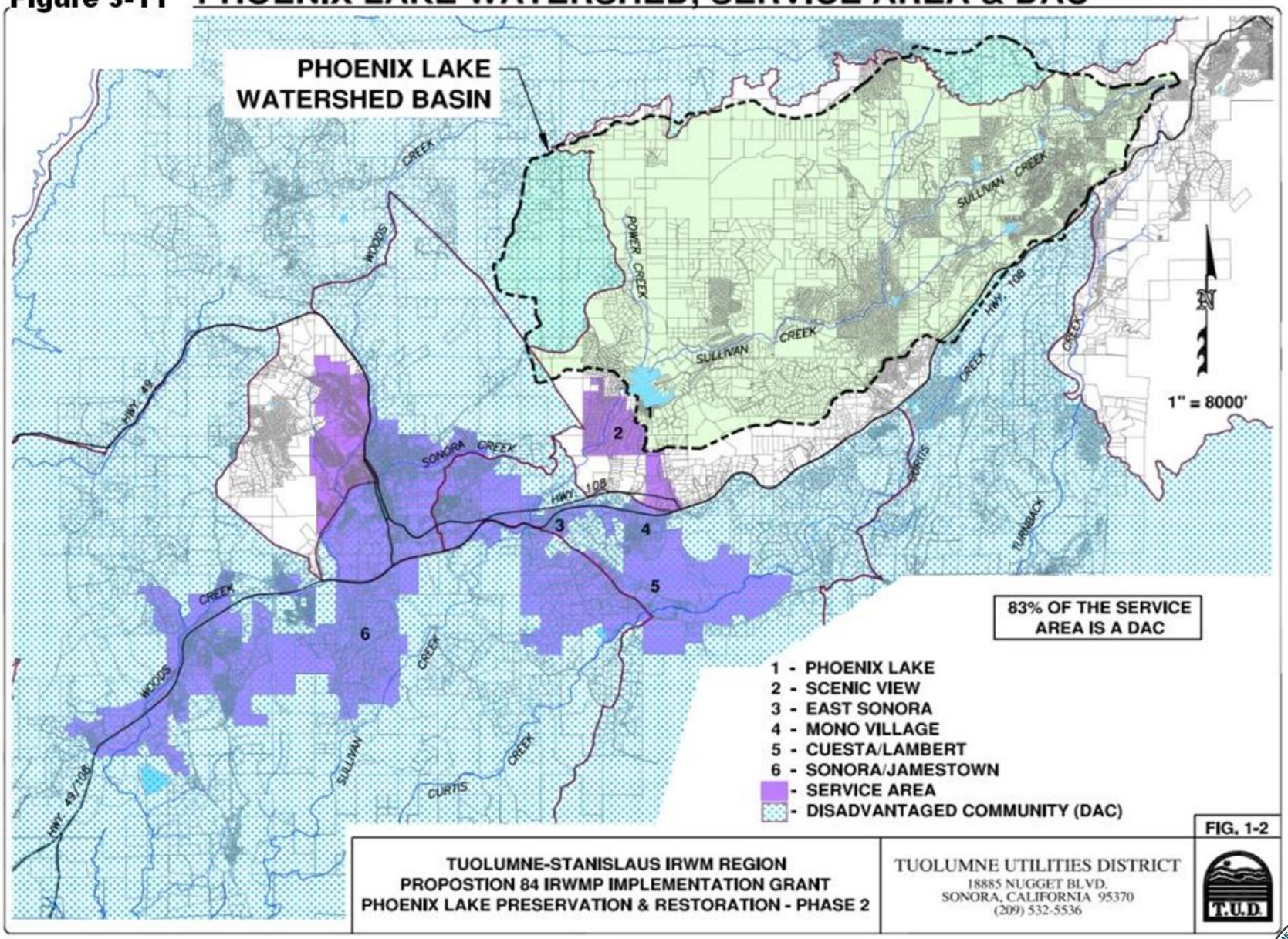
Tuolumne Stanislaus IRWM Region

0.5 to 20 Acre Parcels within the Upper Sullivan Creek Watershed
(Directly Draining into Phoenix Lake Reservoir)



DEPARTMENT OF WATER RESOURCES
STATE OF CALIFORNIA

Figure 3-11 PHOENIX LAKE WATERSHED, SERVICE AREA & DAC



Benefits of Integrated Projects

- Improved water quality
- Improved wildlife habitat
- Increased water storage capacity
- Increased watershed health
- Increased public access
- Project sustainability

Sustainability & Climate Change

CABY Problem Statement

- Potential Problem: Runoff forecasts for the upper American River watershed predict higher winter flows, less snowpack, earlier runoff
- Technical Analysis in Light of Sustainability: Reservoir operations and capacities do not accommodate mid-winter storage; opposite occurs
  - Significant implications to available diversions, reservoir refill, power generation, and downstream environmental flow capabilities.
- Potential Solution: More storage can partially mitigate in-stream and water supply impacts of reduced runoff during high demand period.

Sustainability & Climate Change

CABY Problem Statement – Part 2

- Is more storage the only sustainable solution to climate change?
- How about?
  - Forest Management/Meadow Restoration
    - Applicable to mountain and valley areas
  - Conjunctive Use
    - More applicable to valley areas versus mountains
    - Some storage still needed for practical management
    - Any groundwater overdraft needs to be corrected first

Sustainability & Climate Change

Sierra CC Toolkit

- Prepared by Sierra Nevada Alliance
  - www.sierranevadaalliance.org
- Chapter 4: Adaptation
  - Adaptation Principles for Resource Planning
- Chapter 5: Adaptation Strategies
  - Water & Watershed Management Strategies
  - Wildlife and Habitat Protection Strategies
  - Forestry Management Strategies
  - Wildfire Management Strategies
  - City & County Land-Use Planning Strategies

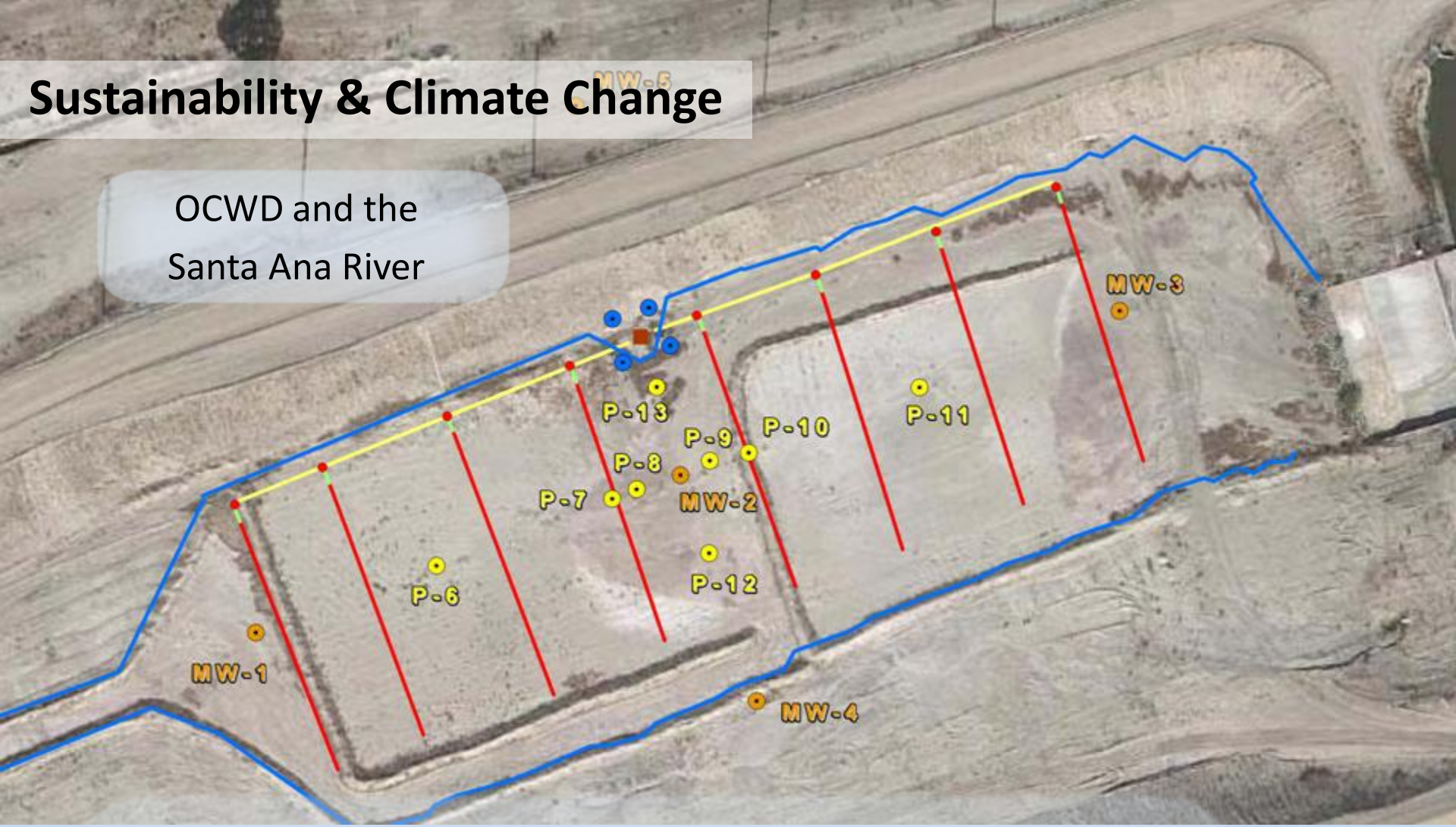
Sustainability & Climate Change

Managed Aquifer Recharge Conference (in Workbook)

- Robust groundwater supplies help build drought tolerance
- Lots of existing technical materials and examples
- Orange County Water District

Sustainability & Climate Change

OCWD and the
Santa Ana River



- Long history of managing spreading basins
- Desire to increase **long-term** groundwater recharge rates
- Pilot study to reduce suspended solids and organic carbon loading
- shallow under-channel lateral drain system

Sustainability & Climate Change

OCWD and the Santa Ana River

Water Quality Parameters	Influent Value Range	Average Percent Removal
Turbidity	8 - 80 NTU	96%
TSS	7 – 37 mg/L	>99%
Chlorophyll A	52 – 68 mg/m3	>99%
Total Organic Carbon (TOC)	6 mg/L	47%
Total Kjeldahl Nitrogen (TKN)	0.8 – 0.9 mg/L	>99%
Iron	0.7 – 0.8 mg/L	80%
Manganese	0.06 mg/L	>99%

Water quality delivered by the passive riverbed filtration system was significantly better than other active treatment technologies evaluated (data not presented), such as cloth filter, flocculation-sedimentation, dissolved air flotation, and ballasted sedimentation.

Thank you

Thank you for your participation!